

Remarks

The Office Action mailed January 5, 2007 has been carefully reviewed and the following remarks have been made in consequence thereof.

Claims 1-20 are now pending in this application. Claims 9, 10, and 15-18 are allowed. Claims 1-8 and 11-14 stand rejected. Claims 19 and 20 are newly added. No fee calculation sheet is needed for the newly added claims. No new matter has been added.

The rejection of Claims 1-3, 6-8, and 14 under 35 U.S.C. § 102(b) as being anticipated by Muzilla et al. (U.S. Pat. No. 5,908,391) ("Muzilla") is respectfully traversed.

Muzilla describes an ultrasound imaging system for increasing spatial resolution and sensitivity of a color flow image. The system uses a plurality of transmit focal zones and a low f-number to enable tight focusing over a large depth-of-field. Each focal zone is fired on a separate acoustic frame, where an acoustic frame is a set of vertical vectors fired from left to right to form a single two-dimensional set of pixel data. The frames are averaged to reduce frame-to-frame flicker by using a frame averaging algorithm. A persistence coefficient is selected (26) and an unfiltered frame (X_n) is compared to an adjacent filtered frame (Y_{n-1}) using the algorithm and coefficient. Frame-averaged current pixel data is displayed.

Claim 1 recites an ultrasonic pulse transmission method comprising "when P ultrasonic pulse transmissions are conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, interleaving, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame."

Muzilla does not describe or suggest an ultrasonic pulse transmission method as recited in Claim 1. Specifically, Muzilla does not describe or suggest a method that includes interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one

ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame. The averaging of frames in Muzilla is not a description or a suggestion of interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame.

Accordingly, for the reasons set forth above, Claim 1 is submitted to be patentable over Muzilla.

Claims 2, 3, and 6 depend from independent Claim 1. When the recitations of Claims 2, 3, and 6 are considered in combination with the recitations of Claim 1, Applicant submits that dependent Claims 2, 3, and 6 likewise are patentable over Muzilla.

Claim 7 recites an ultrasonic diagnostic apparatus comprising “an ultrasonic probe . . . a number-of-frames defining device for defining a number of frames f . . . a transmitting/receiving device for driving said ultrasonic probe to conduct P ultrasonic pulse transmissions in one direction and receive echoes to acquire a first acoustic line signal that belongs to a first one of the frames, wherein P is at least equal to two . . . and a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.”

Muzilla does not describe or suggest an ultrasonic diagnostic apparatus as recited in Claim 7. Specifically, Muzilla does not describe or suggest an ultrasonic diagnostic apparatus that includes a transmission direction control device configured to control a transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in a direction to acquire a first acoustic line signal that belongs to a first one of the frames, at least one ultrasonic pulse transmission to

acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame. The averaging of frames in Muzilla is not a description or a suggestion of a transmission direction control device configured to control a transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in a direction to acquire a first acoustic line signal that belongs to a first one of the frames, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.

Accordingly, for the reasons set forth above, Claim 7 is submitted to be patentable over Muzilla.

Claims 8 and 14 depend from independent Claim 7. When the recitations of Claims 8 and 14 are considered in combination with the recitations of Claim 7, Applicant submits that dependent Claims 8 and 14 likewise are patentable over Muzilla.

For at least the reasons set forth above, Applicant respectfully requests that the Section 102 rejection of Claims 1-3, 6-8, and 14 be withdrawn.

The rejection of Claims 4, 11, and 12 under 35 U.S.C. § 103(a) as being unpatentable over Muzilla in view of Mochizuki et al (U.S. Pat. No. 5,152,294) ("Mochizuki") is respectfully traversed.

Muzilla is described above. Mochizuki describes an ultrasonic transducer (28) coupled to a swing mechanism (26) within a scanner case (22) such that the ultrasonic transducer (28) may be rotated in a direction normal to an arrangement direction of an array (30) of transducer elements (30a). Swinging a two-dimensional acquisition plane (S) of the transducer (28) normal to the arrangement direction of the array transducer (30) enables a three-dimensional data acquisition area (V) to be scanned. Mochizuki further describes that ultrasonic scanners transmit ultrasonic beams, receive reflected echoes, and display a cross-sectional image layer of a scanned object based on the received echoes.

Claim 4 depends from independent Claim 1, which recites an ultrasonic pulse transmission method comprising “when P ultrasonic pulse transmissions are conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, interleaving, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame.”

Neither Muzilla nor Mochizuki, considered alone or in combination, describes or suggests an ultrasonic pulse transmission method as recited in Claim 1. Specifically, neither Muzilla nor Mochizuki, considered alone or in combination, describes or suggests a method that includes interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Mochizuki describes a mechanism of a mechanical four-dimensional probe. The averaging of frames in Muzilla, and the probe mechanism in Mochizuki are not descriptions or suggestions of interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame.

Accordingly, for the reasons set forth above, Claim 1 is submitted to be patentable over Muzilla in view of Mochizuki.

When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, Applicant submits that dependent Claim 4 likewise is patentable over Muzilla in view of Mochizuki.

Claims 11 and 12 depend from independent Claim 7, which recites an ultrasonic diagnostic apparatus comprising “an ultrasonic probe . . . a number-of-frames defining device for defining a number of frames f . . . a transmitting/receiving

device for driving said ultrasonic probe to conduct P ultrasonic pulse transmissions in one direction and receive echoes to acquire a first acoustic line signal that belongs to a first one of the frames, wherein P is at least equal to two . . . and a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.”

Neither Muzilla nor Mochizuki, considered alone or in combination, describes or suggests an ultrasonic diagnostic apparatus as recited in Claim 7. Specifically, neither Muzilla nor Mochizuki, considered alone or in combination, describes or suggests an ultrasonic diagnostic apparatus that includes a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Mochizuki describes a mechanism of a mechanical four-dimensional probe. The averaging of frames in Muzilla, and the probe mechanism in Mochizuki are not descriptions or suggestions of a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.

Accordingly, for the reasons set forth above, Claim 7 is submitted to be patentable over Muzilla in view of Mochizuki.

When the recitations of Claims 11 and 12 are considered in combination with the recitations of Claim 7, Applicant submits that dependent Claims 11 and 12 likewise are patentable over Muzilla in view of Mochizuki.

Moreover, Applicant respectfully submits that the Section 103 rejection of Claims 4, 11, and 12 is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Muzilla nor Mochizuki, considered alone or in combination, describes or suggests the claimed invention. Further, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine the probe mechanism of Mochizuki with the frame averaging of Muzilla to arrive at the claimed invention because there is no motivation to combine the references suggested in the cited art itself.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicant's disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion nor motivation to combine the prior art disclosures, or any reasonable expectation of success has been shown.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Mochizuki describes a mechanism of a mechanical four-dimensional probe. Since there is no

teaching or suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 4, 11, and 12 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the rejection of Claims 4, 11, and 12 under 35 U.S.C. 103(a) as being unpatentable over Muzilla in view of Mochizuki be withdrawn.

The rejection of Claims 5 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Muzilla in view of Dubberstein et al (U.S. Pat. No. 6,159,153) ("Dubberstein") is respectfully traversed.

Muzilla is described above. Dubberstein describes an ultrasound transducer (120) that transmits a plurality of ultrasound beams (130 and 130b) in a plurality of transmit directions and at a plurality of transmit frequencies to reduce interference between two ultrasound beams (130 and 130b) such that a frame rate may be increased.

Claim 5 depends from independent Claim 1, which recites an ultrasonic pulse transmission method comprising "when P ultrasonic pulse transmissions are conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, interleaving, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame."

Neither Muzilla nor Dubberstein, considered alone or in combination, describes or suggests an ultrasonic pulse transmission method as recited in Claim 1. Specifically, neither Muzilla nor Dubberstein, considered alone or in combination, describes or suggests a method that includes interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first

frame. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Dubberstein describes an ultrasound transducer that transmits a plurality of ultrasound beams in a plurality of transmission directions and frequencies. The averaging of frames in Muzilla, and the transmission of a plurality of ultrasound beams in a plurality of transmission directions and frequencies in Dubberstein are not descriptions or suggestions of interleaving, between P ultrasonic pulse transmissions conducted in one direction to acquire a first acoustic line signal that belongs to a first frame, at least one ultrasonic pulse transmission for acquiring a second acoustic line signal that belongs to a second frame different from the first frame.

Accordingly, for the reasons set forth above, Claim 1 is submitted to be patentable over Muzilla in view of Dubberstein.

When the recitations of Claim 5 are considered in combination with the recitations of Claim 1, Applicant submits that dependent Claim 5 likewise is patentable over Muzilla in view of Dubberstein.

Claim 13 depends from independent Claim 7, which recites an ultrasonic diagnostic apparatus comprising “an ultrasonic probe . . . a number-of-frames defining device for defining a number of frames f . . . a transmitting/receiving device for driving said ultrasonic probe to conduct P ultrasonic pulse transmissions in one direction and receive echoes to acquire a first acoustic line signal that belongs to a first one of the frames, wherein P is at least equal to two . . . and a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.”

Neither Muzilla nor Dubberstein, considered alone or in combination, describes or suggests an ultrasonic diagnostic apparatus as recited in Claim 7. Specifically, neither Muzilla nor Dubberstein, considered alone or in combination, describes or suggests an ultrasonic diagnostic apparatus that includes a transmission

direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames. Rather, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Dubberstein describes an ultrasound transducer that transmits a plurality of ultrasound beams in a plurality of transmission directions and frequencies. The averaging of frames in Muzilla, and the transmission of a plurality of ultrasound beams in a plurality of transmission directions and frequencies in Dubberstein are not descriptions or suggestions of a transmission direction control device configured to control the transmission direction to interleave, between the P ultrasonic pulse transmissions conducted in the direction to acquire the first acoustic line signal, at least one ultrasonic pulse transmission to acquire a second acoustic line signal that belongs to a second one of the frames different from the first one of the frames.

Accordingly, for the reasons set forth above, Claim 7 is submitted to be patentable over Muzilla in view of Dubberstein.

When the recitations of Claim 13 are considered in combination with the recitations of Claim 7, Applicant submits that dependent Claim 13 likewise is patentable over Muzilla in view of Dubberstein.

Moreover, Applicant respectfully submits that the Section 103 rejection of Claims 5 and 13 is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Muzilla nor Dubberstein, considered alone or in combination, describes or suggests the claimed invention. Further, in contrast to the assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine the plurality of ultrasound beams of Dubberstein with the frame averaging of Muzilla to arrive at the claimed invention because there is no motivation to combine the references suggested in the cited art itself.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levensgood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicant's disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion nor motivation to combine the prior art disclosures, or any reasonable expectation of success has been shown.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Muzilla describes shifting a transmit focal zone within the region of interest for every frame using Power Doppler Mode, averaging the frames in which the focus is shifted, and displaying an averaged frame, and Dubberstein describes an ultrasound transducer that transmits a plurality of ultrasound beams in a plurality of transmission directions and frequencies. Since there is no teaching or suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 5 and 13 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the rejection of Claims 5 and 13 under 35 U.S.C. 103(a) as being unpatentable over Muzilla in view of Dubberstein be withdrawn.

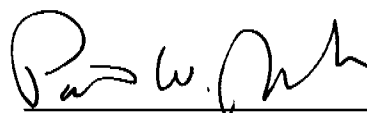
Newly added Claim 19 depends from independent Claim 1, which is submitted to be in condition for allowance and is patentable over the cited art. For at least the reasons set forth above, Applicant respectfully submits that Claim 19 is also patentable over the cited art.

Newly added Claim 20 depends from independent Claim 7, which is submitted to be in condition for allowance and is patentable over the cited art. For at least the reasons set forth above, Applicant respectfully submits that Claim 20 is also patentable over the cited art.

Claims 9, 10, and 15-18 have been indicated as being allowed. Applicant thanks the Examiner for allowing Claims 9, 10, and 15-18.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,



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